

TUSONIX DISC CERAMIC CAPACITORS

Ceramic capacitors, because of their inherent reliability, small size, low cost and wide choice of electrical characteristics available, now outsell all other types combined. TUSONIX manufactures both fixed and variable ceramic capacitors in a broad range of capacitance values, shapes and sizes for the most complete selection in the industry. The most widely used of all are the ceramic disc capacitors which are described in this catalog.

The following pages describe the electrical properties and physical dimensions of TUSONIX's ceramic disc capacitors, capacitance values from 1pF to .06 μ F and D.C. voltage

ratings up to 6000 are included. Within each of the rated voltage classifications a variety of other electrical properties may be selected.

From the standpoint of use, the many ceramic disc capacitors made by TUSONIX can be broadly classified and characterized as follows:

1. **Temperature Compensating** — highest Q, minute capacitance change with temperature, more stable than glass or mica.
2. **Extended Temperature Compensating** — finite and repeatable capacitance change

with temperature, also high Q and stability second only to preceding.

3. **High Dielectric Constant** — high capacitance, low dissipation factor replaces paper, film, glass, mica in general purpose applications — biggest seller.

There is considerable overlap in the electrical characteristics of the above categories. This catalog lists the specifications for all significant electrical characteristics so that circuit designers may select the capacitor best suited for each specific application.

TO ORDER:

Specify TUSONIX style number, voltage, TC code, capacitance, tolerance, and any special instructions.

Example:

831-500V-Z5U-1000 pf $\pm 20\%$
20 AWG outside kink leads,
.187 \pm .025" lead length.

Occasionally, to expedite delivery, TUSONIX will use a more stable Hi-K formulation than ordered.

NOTES:

1. Derate to 67% of rated voltage for +125°C operation.
2. Derate to 60% of rated voltage for +125°C operation.
3. For +85°C operation.

Metric dimensions are designated in this catalog in the following manner:

inches mm	inches/mm
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APPLICATIONS AND FEATURES

TUSONIX Ceramic Disc Capacitors offer high performance in a complete range of ratings, values and sizes. The complete line of voltage ratings offers the designer the convenience of selecting the exact capacitor rating required for his application. Where voltage rating is not critical, we recommend our standard 500 volt line.

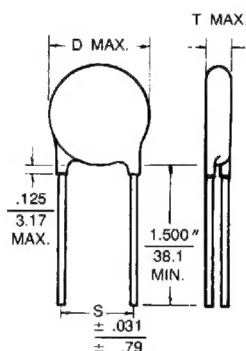
Temperature Compensating Ceramic Capacitors (NPO thru N750) are ideal for applications requiring very precisely controlled capacitance change with temperature, high Q and very small capacitance tolerance.

Extended Temperature Compensating Disc Capacitors (N1500 thru N5600) are capacity sensitive to temperature in varying degrees, and are useful as temperature compensating elements for stabilization over a wide temperature range. They are also widely used in tuning and resonant circuits.

TUSONIX General Purpose or Hi-K

Ceramic Disc Capacitors are available in a broad range of dielectric constants. This allows a wide selection of capacitance values.

PHYSICAL CHARACTERISTICS



1. For D, T & S dimensions, see individual charts.
2. See individual charts for standard wire gauge. All values up to and including 2 kV are available with 20, 22 and 24 AWG leads, except body sizes .655" max. and larger available with 20 or 22 AWG only. All values up to and including 6 kV are available with 20 or 22 AWG leads.
3. Body insulation — conformal coating.
4. Standard max. coating on leads is .125"; closer control is optional at extra cost.
5. Marking — Trademark, Cap, Tol., T.C., and Voltage (Voltage omitted on 500V).

SPECIALS

Special disc products are available from TUSONIX upon request. Details on TUSONIX's approval for U.L. line by-pass capacitors and approval to Mil-C-20 and Mil-C-11015 can be found elsewhere in this catalog.

Special physical requirements are also available. This includes the lead types shown on page 13. Special lead spacing requirements are optional upon request, in addition to the standard nominal lead spacings shown in the capacitance charts.

TUSONIX has an excellent background in High Reliability products, and is well known throughout the industry for quality and reliability. TUSONIX's Engineering Department is at your disposal to answer questions and make recommendations concerning any type of special testing and manufacturing required. We are proud of our years of experience and vast accumulation of data, which we encourage you to use.

TUSONIX

DISC CERAMIC CAPACITORS

1 and 2kV

TUSONIX STYLE NUMBER	868	838	808	858	878	818	848	828	3848	3858	3878	3888
MAXIMUM DIAMETER (D)	.200/5.08	.300/7.62	.370/9.40	.447/11.35	.500/12.70	.603/15.32	.685/17.40	.760/19.30	.810/20.60	.885/22.48	.947/24.05	1.110/28.20
LEAD SPACING (S)	.250/6.35	.250/6.35	.250/6.35	.250/6.35	.250/6.35	.375/9.52	.375/9.52	.375/9.52	.375/9.52	.375/9.52	.375/9.52	.375/9.52
WIRE GAUGE (AWG)	22	22	22	22	22	22	22	22	20	20	20	20

		TEMP. CHAR. CODE	N O T E	MIN CAP TOL (%)	MIN TC TOL	MAX DF (%)	MIN Q	1kV — MAXIMUM NOMINAL CAPACITANCE (pF)														
		THICKNESS .156" MAX.																				
GENERAL PURPOSE H-K	Z5D Y5E X5F X7F			±5		2		100	140	245	380	540	900	1200	1400	1450	1500	1600	1700			
	Z5D Y5E X5F X7R	1		±5		2		300	470	820	1200	1700	3000	4000	4700	4800	5300	5400	5600			
	Z5F Y5F X5F X7P	1		±10		2		375	700	1200	1900	2500	4500	6000	7000	7400	8000	8200	8500			
	Z5F Y5F X5R X7S	2		±10		2		500	950	1700	2700	3800	6400	8500	10000	10300	11000	11500	12000			
	Z5U Y5U X5U X7V	2		±20		2		1000	1200	2000	3200	4500	7500	10500	12000	15000	19000	21000	22000			
	Z5U Y5V X5W X7W	2		±20		3		1500	2000	3500	5400	7400	12000	16000	20000	25000	30000	34000	35000			
TEMPERATURE COMPENSATING EXTENDED TEMPERATURE COMPENSATING	NPO	C0G	1	±1	±30		1000	20	1-27	45	70	95	120	150	210	250	270	280	290			
	N033	S1G	1	±1	±30		1000	5	1.3-11	20	30	40	65	90	100	130	135	140	150			
	N080	U1G	1	±1	±30		1000	6	1.8-12	21	33	45	75	100	120	150	155	160	170			
	N150	P2G	1	±1	±30		1000	7	2.0-14	24	38	50	85	110	140	170	175	180	200			
	N220	R2G	1	±1	±30		1000	7	2.1-15	27	41	55	95	130	150	190	195	200	220			
	N330	S2H	1	±1	±60		1000	8	2.3-17	30	46	60	100	140	170	200	220	230	250			
	N470	T2H	2	±1	±60		1000	13	2.6-27	46	70	100	160	200	225	250	260	270	290			
	N750	U2J		±2	±120		1000	25	3.5-50	80	120	170	280	380	460	480	520	540	560			
	N1500	P3K	1	±2	±250		1000	24	6-50	86	130	175	290	390	470	590	600	640	690			
	N2200	R3A	2	±2	±400		500	27	7-56	95	150	200	330	450	540	670	700	730	790			
	N3300	S3B	3	±5	±650		500	48	12-100	170	260	350	580	780	930	1100	1150	1200	1400			
	N4200	S3C	3	±5	±850		500	55	22-110	180	290	390	640	870	1000	1300	1600	1800	2500			
	N4700	T3D	3	±5	±900		200	65	25-130	220	340	460	770	1000	1200	1500	1900	2100	2900			
	N5600	H3M	3	±5	±1000		200	100	38-200	340	520	700	1100	1500	1800	2300	2800	3300	4400			

		TEMP. CHAR. CODE	N OTE	MIN CAP TOL (%)	MIN TC TOL	MAX DF (%)	MIN Q	2kV — MAXIMUM NOMINAL CAPACITANCE (pF)												
		THICKNESS .187" MAX.																		
GENERAL PURPOSE H-K	Z5D Y5E X5F X7F		±5			2		70	120	190	270	450	610	750	910	1100	1270	1700		
	Z5D Y5E X5F X7R	1	±5			2		240	420	660	910	1500	2000	2500	3000	3700	4200	5600		
	Z5F Y5F X5F X7P	1	±10			2		350	600	960	1300	2200	3100	3800	4600	5600	6400	8500		
	Z5F Y5F X5R X7S	2	±10			2		490	860	1300	1900	3200	4300	5300	6400	7900	9000	12000		
	Z5U Y5U X5U X7V	2	±20			2		610	1000	1600	2300	3900	5300	6400	7900	9600	11000	14500		
	Z5U Y5V X5W X7W	2	±20			3		1000	1800	2700	3700	6100	8300	10000	12000	15000	17000	23000		
TEMPERATURE COMPENSATING EXTENDED TEMPERATURE COMPENSATING	NPO	C0G	±1	±30		1000		1-10	20	30	40	70	100	120	150	190	220	250		
	N033	S1G	1	±1	±30	1000		1.5-5.4	9.3	14	19	32	45	50	65	75	90	120		
	N080	U1G	1	±1	±30	1000		1.8-6.3	10	16	22	37	50	60	76	90	100	140		
	N150	P2G	1	±1	±30	1000		2.0-7.2	12	19	25	42	55	70	85	100	120	160		
	N220	R2G	1	±1	±30	1000		2.0-7.9	13	20	28	46	65	75	95	115	130	175		
	N330	S2H	1	±1	±60	1000		2.4-8.8	15	23	31	50	70	85	100	120	140	200		
	N470	T2H	2	±1	±60	1000		2.8-13	22	34	46	75	110	130	160	190	220	285		
	N750	U2J		±2	±120	1000		3.8-20	40	60	85	130	190	220	280	340	380	500		
	N1500	P3K	1	±2	±250	1000		4.6-24	42	65	95	140	200	230	290	350	400	560		
	N2200	R2A	2	±2	±400	500		7.2-28	48	75	100	150	220	270	330	400	460	630		
	N3300	S3B	3	±5	±650	500		12-50	85	100	130	170	290	390	470	700	590	1100		
	N4200	S3C	3	±5	±850	500		22-55	95	140	190	320	440	530	660	810	910	1200		
	N4700	T3D	3	±5	±900	200		25-67	110	170	230	390	530	630	790	970	1100	1500		
	N5600	H3M	3	±5	±1000	200		38-100	170	260	360	590	800	950	1200	1400	1600	2200		

TUSONIX DESIGN SPECIFICATIONS

AGING

All hi-dielectric constant barium titanate based ceramics have a predictable capacitance aging effect. The effect is a loss of capacitance with time. The loss is an inverse logarithmic function and is based on the capacitance value obtained at a given time after the last heat exposure. By the time the user receives the parts, almost all the aging effects are gone, but from time to time it is possible to get "fresh" parts where the aging rate is still taking place fast enough to be noticeable. It's also possible to start the aging over again if the user subjects the part to prolonged temperatures above 100°C (such as during a potting cure cycle; during high temperature environmental tests, etc.).

HiK TEMPERATURE CHARACTERISTICS

EIA Code	Temperature Range
Z5	-10 C to +85 C
Y5	30 C to +85 C
X5	55 C to +85 C
*X7	55 C to +125 C
EIA Code	Maximum Cap. Change
D	-3.3%
E	-4.7%
F	-7.5%
P	-10%
R	-15%
S	-22%
T	-22% 33%
U	-22% 56%
V	-22% 82%
W	-22% 90%

*Formerly designated TUSONIX-W5

TEMPERATURE COEFFICIENTS (Temperature Characteristic)

The TUSONIX catalog lists the various temperature characteristics using standard EIA code symbols. The Hi-K characteristics are treated as maximums and parts supplied as a particular type will drift less than the maximum listed. The T.C. characteristic for temperature compensating types is the nominal capacitance change between 25°C and 85°C in parts per million per degree centigrade. The maximum departure (plus or minus) from this nominal is listed in the catalog for values exceeding 10 pF. The table below shows T.C. tolerances for values below 10 pF.

Temperature Coefficient	Capacitance
	.4 to 2 pF 2.1 to 3.9 pF 4 thru 9.9 pF
NP0 thru N330	±250(K) ±120(J) ±060(H)
N470 thru N750	±250(K) ±120(J) ±120(J)
N1500 and up	Same as for 10 pF and over

CAPACITANCE TOLERANCE

Nominal Capacitance 10 pF or Less	Code	Nominal Capacitance over 10 pF and all Resistance Values
±.1 pF	A	+50 20°
±.25 pF	B	
±.5 pF	C	
±.3 pF	D	
±1 pF	E	-70 30°
±2 pF	F	-1%
±3%	G	-2%
	H	-3%
	I	+60 40°
±5%	J	-5%
+10%	K	-10%
±2%	L	+100° 40
±20%	M	-20%
±4 pF	N	+30%
	P	-100 0°
±0.2 pF	Q	-15%
	R	+2.5%
	S	+50 15°
	T	+30 20°
	U	-80 0°
	V	±7.0%
	W	+50 30°
	X	-40 10°
	Y	+50 0°
	Z	+80 -20°